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CERMAK & KENEALY LLP
515 E. BRADDOCK RD
SUITE B
ALEXANDRIA, VA 22314

EXAMINER	
PRICE, CARL D	

ART UNIT	PAPER NUMBER
3749	

DATE MAILED: 12/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/814,167	CARREA, ELISABETTA	
	Examiner	Art Unit	
	CARL D. PRICE	3749	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/03/2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims **1-28** have been considered but are moot in view of the new ground(s) of rejection.

Applicant has amended the claims to be of a scope not previously considered. Consistent with applicant's argument that the prior art relied on in the previous office action fail to show, disclose and/or teach certain aspects of applicant's invention now recited in the claims filed on **11/03/2006,** applicant has amended the claims to include at least the following:

Claim 1. (Currently Amended) A combustion process comprising:

forming a **substantially nitrogen-free** gas mixture from **oxidant,** fuel, and inert gas; and
combusting said gas mixture in a burner, wherein combusting comprises flameless combustion.
(Highlighting and Underlining Added)

With regard to the claimed and disclosed invention applicant alleges the following:

"The claimed combinations lead to a synergistic effect, since a combustion process operating with flameless combustion is particularly suitable for the combustion of weakly reactive gas mixtures. Where a weakly reactive gas mixture is to be burnt, in particular where the oxygen of the gas mixture to be burnt, with the mixture obtained by, e.g., means of an oxygen transport membrane with rather large scavenging gas quantity, the output capability of the combustion process operating nitrogen-free can be distinctly improved by the combination, according to the invention, of a combustion process operating nitrogen-free with a flameless operating combustion process. **The synergistic effect is not expected, because prior combustion processes operating with flameless combustion have been used expressly for the reduction of NOX formation or NOX emissions**. These, however, do not exist at all in the case of a combustion process operating nitrogen-free. To this extent, the present invention uses the combustion process operating with flameless combustion for a different purpose, because the use of flameless combustion in a combustion process operating nitrogen-free permits reliable and stable combustion of a weakly reactive gas mixture.

Thus, one aspect of the invention includes the use of flameless combustion (known for reducing NOX formation) in a combustion process operating without nitrogen, i.e., a process in which the reduction of NOX formation is nonsensical. The synergy available by the present invention, that the combustion of weakly

> reactive nitrogen-free gas mixture can be stabilized, cannot be expected by the person of ordinary skills in the art."
>
> (Underlining and Highlighting Added)

Applicant is however reminded that the Supreme Court reaffirmed and relied upon the Graham three pronged test in its consideration and determination of obviousness in the fact situations presented in Sakraida v. Ag Pro, Inc., 425 U.S. 273, 189 USPQ 449, reh 'g denied, 426 U.S. 955 (1976) and Anderson 's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57, 163 USPQ 673 (1969). In each case, the Court discussed whether the claimed combinations produced a "new or different function" and a "synergistic result," but it clearly decided whether the claimed inventions were nonobviousness on the basis of the three-way test in Graham. Nowhere in its decisions in these cases does the Court state that the "new or different function" and "synergistic result" tests supersede a finding of nonobvious or obviousness under the Graham test. Accordingly, the test for patentability under 35 U.S.C. 103 set forth in Graham. It should be noted that the Supreme Court's application of the Graham test to the fact circumstances in Ag Pro was somewhat stringent, as it was in Black Rock. Note Republic Industries, Inc. v. Schlage Lock Co., 592 F.2d 963; 200 USPQ 769 (7th Cir. 1979). The Court of Appeals for the Federal Circuit stated in Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1540, 218 USPQ 871, 880 (Fed. Cir. 1983) that A requirement for "synergism" or a "synergistic effect" is nowhere found in the statute, 35 U.S.C. When present, for example in a chemical case, synergism may point toward nonobviousness, but its absence has no place in evaluating the evidence on obviousness. The more objective findings suggested in Graham, supra, are drawn from the language of the statute and are fully adequate guides for evaluating the evidence relating to compliance with 35 U.S.C. § 103. Bowser Inc. v. United States, 388 F. 2d 346, 156 USPQ 406 (Ct. Cl. 1967). The examiner maintains the position that the claims rejected are obvious over the combination of teachings presented by the prior art at the time of the invention. Further in this regard, other than the mere allegation of patentability, applicant has failed to originally disclose and has not separately presented factual evidence that would otherwise point to nonobviousness of the invention over the prior art of record.

With regard to the scope of the claimed invention now presented the prior art reference of **US005724805 (Glombe et al)** (of record) as well as other prior art teachings, such as **US005154599 (Wunning)** (of record), are now relied on to form the basis of claims rejected. Most notably, **US005724805 (Glombe et al)** discloses a power plant method and arrangement relying on an air separation unit for removing nitrogen from air to provide a substantially nitrogen-free source of oxidant being mixed with a flow of inert, and substantially nitrogen-free exhaust gas produced during combustion of the oxidant/inert recirculated exhaust gas with substantially nitrogen-free fuel gas, such as natural gas. (See US004488869 (Voorheis): " ... *burning **fuels** having a **very low nitrogen content, such as natural gas***"; and US004851201 (Garride et al: "*Because the "thermal fixation" of atmospheric nitrogen is exclusively a high temperature phenomenon, occurring above 2800.degree. F., it has been possible to achieve significant reductions in NO.sub.x emissions from the combustion of **nitrogen-free fuels** (such as **natural gas** or gasoline) by reducing the overall temperature in the combustion zone. **This is accomplished using techniques such as exhaust gas recirculation in automobiles or flue gas recirculation** in utility boilers.")*(Highlighting and Underlining Added)

The prior art reference of **US005154599 (Wunning)** (of record) explicitly discloses the "*... **NOx values** occurring in **flameless oxidation** are lowered to **far below** the values that would occur if the fuel were combusted with flames without preheating of the combustion air*". (Highlighting and Underlining Added)

In view of the teachings of at least **US005724805 (Glombe et al)** (of record) and **US005154599 (Wunning)** (of record) the examiner maintains the claimed invention as being obvious under 35 USC103, since it would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to combine these teachings into a single operative system or method producing minimal NOx formation. See below.

JP10-89614 (see the English language Abstract) is now relied on to teach that, in a low nitrogen oxide gas forming combustion system including flue gas recirculation, it would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to,

for at least the purpose of eliminating the use of a pilot burner, preheat the combustible mixture to a temperature greater than the spontaneous ignition temperature, or self-ignition temperature.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims: Rejected under 35 U.S.C. 103(a)

Claims **1, 2, 4, 5-10, 22-25** and **28** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US005724805 (Glombe et al)** (of record) in view of **US005154599 (Wunning).**

US005724805 (Glombe et al) show and disclose a gas turbine electric power generation and combustion process including:

- forming a substantially nitrogen-free gas mixture from oxidant, fuel (natural gas), and inert gas (CO_2); and
- wherein the gas mixture comprises mixing the fuel or a mixture of fuel and inert gas at least at two locations (16, 18a, 19) in the burner arranged sequentially relative to a through-flow direction of the burner;
- combusting the mixture in a gas turbine power generation system.

In this regard **US005724805 (Glombe et al)** discloses the following:

> 10) FIG. 1 shows the overall design of a natural gas-fired power plant according to the invention. As shown in FIG. 1, air is separated in the **AS/CC unit** into liquid O.sub.2, gaseous N.sub.2, and argon (Ar). The gaseous N.sub.2 can be either vented into the atmosphere or sold as a by-product. The argon is produced as a by-product. The liquid O.sub.2 is compressed, e.g., to 17 bar, then sent to the CO.sub.2 liquefier to be evaporated while condensing the gaseous CO.sub.2. The evaporated **O.sub.2 is then sent to the combustor of the gas turbine.** The combustion products are essentially CO.sub.2 and H.sub.2 O, which are used to generate power in the **gas turbine**.
>
> (70) It is also noted that this plant, fired either by **pure NG or SG**, produces no nitrogen oxides (NO.sub.x). **Since NG or SG are combusted in almost pure oxygen (99.5+% pure),** there is no opportunity to form NO.sub.x in the combustor. CHEMKIN computer code calculations confirm that the concentration of NO.sub.x will be only in the tens of parts per million by volume (ppmV) in the flue gas when NG or SG are combusted in 99.5 percent oxygen and 0.5 percent nitrogen. Preferably this number is less than 100 ppmV of NO.sub.x. (Highlighting and Underlining Added)
>
> (93) When a sufficient amount of CO.sub.2 for the working fluid has accumulated, **the plant will continuously recycle about 95 percent of the total CO.sub.2 recovered from the exhaust gas**. This total amount of CO.sub.2 includes previously recycled CO.sub.2 and CO.sub.2 newly produced by combustion. **In this steady state operation,** about 5 percent of the total CO.sub.2 recovered is liquefied and removed from the plant. This constitutes an amount of CO.sub.2 equal to 100 percent of the CO.sub.2 newly produced by combustion in the plant.
>
> (94) **Once operating under steady state conditions,** the plant described above will generate 210 MW of electricity and 51 tonnes of process stream per hour, and will also produce saleable by-products, including 9878 tonnes of nitrogen, 162 tonnes or argon and 2102 tonnes of liquid carbon dioxide per day. Considering the fact that the plant produces these valuable by-products, it is highly profitable besides being environmentally "clean." The novel concepts and techniques described above, namely the integrated AS/CC unit and the CEM, push the net power efficiency of the NG-fired plant to 45% and that of the gasified coal-fired or SG-fired plant to 36.6%. The net efficiency reaches 47% when LNG is used instead of NG.
>
> (95) The efficiency losses due to CO.sub.2 recovery are relatively modest when one considers the environmental gains of nearly 100% CO.sub.2 recovery, no sulfur oxides, no nitrogen oxides, and no particulate emissions. Furthermore, the new plants produce saleable by-products, which makes them economically competitive with advanced conventional power plants.
> (Highlighting and Underlining Added)

US005724805 (Glombe et al) shows and discloses the invention substantially as set forth in the claims with possible exception to the combustion occurring as flameless combustion.

US005154599 (Wunning) explicitly discloses and teaches, from applicant's same NOx gas reducing burner field of endeavor, the "... ***NOx values*** *occurring in* ***flameless oxidation*** *are lowered to* ***far below*** *the values that would occur if the fuel were combusted with flames without preheating of the combustion air".* (Highlighting and Underlining Added)

US005154599 (Wunning) the exhaust gas guidance device comprises a cross-sectional expansion (at 11).

US005154599 (Wunning) discloses the following:

> (18) This method operates with an extremely high rate of exhaust gas recirculation (r.gtoreq.2), so that even with complete air preheating (.epsilon.=1), the maximum temperatures (1500.degree. C.) that occur upon oxidation are lower than in the case of combustion of the fuel in flames. Despite high air preheating and thus optimal exploitation of the exhaust gas heat, **the NOx values occurring in flameless oxidation are lowered to far below the values that would occur if the fuel were combusted with flames without preheating of the combustion air.** Thus the novel method has virtually overcome the previously existing conflict between the goals of energy economy from air preheating and the most extensive possible avoidance of the formation of nitrogen oxides. Moreover, as experience has confirmed, the noise level in the combustion chamber is drastically reduced in the novel method compared with the noise produced in combustion with flames, because the pressure fluctuations in the flame front that are definitive for noise production are omitted.

(Underlining and Highlighting Added)

In regard to claims **1, 2, 4, 6-10, 22, 23** and **28**, for the purpose of lowering the NOx values, it would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combustor of **US005724805 (Glombe et al)** to operate under flameless oxidation conditions by preheating the oxidant and retaining and re-circulating a part of the exhaust gases in the combustion chamber gas, defined by a guidance device comprises a cross-sectional expansion. In regard to claims **5** and **24**, since the required volume ratio of inert gas and oxygen for a given combustion system would necessarily depend on a variety of design concerns and/or parameters, such as the over all shape and size of the apparatus, the type and amount of fuel used, etc., to form or operate **US005724805 (Glombe et al)** in accordance with the limitations set forth in these claims can be viewed as nothing more that merely matters of

choice in design, absent the showing of any new or unexpected results produced therefrom over the prior art of record.

Claims: Rejected under 35 U.S.C. 103(a)

Claims **3, 12, 13, 14, 16, 20, 21,** and **25** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US005724805 (Glombe et al)** (of record) in view of **US005154599 (Wunning),** as applied above, and further in view of **JP10-89614.**

JP10-89614 (see the English language Abstract) teaches that, in a low nitrogen oxide gas forming combustion system including flue gas recirculation, it would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to, for at least the purpose of eliminating the use of a pilot burner, preheat the combustible mixture to a temperature greater than the spontaneous ignition temperature, or self-ignition temperature.

In regard to claims **3, 12, 13, 14, 20, 21** and **25**, for at least the purpose of eliminating the use of a pilot burner, it would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify **US005724805 (Glombe et al)** to preheat the combustible mixture to a temperature greater than the spontaneous ignition temperature, or self-ignition temperature.

Claims: Rejected under 35 U.S.C. 103(a)

Claims **11** and **15** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US005724805 (Glombe et al)** (of record) in view of **US005154599 (Wunning)** (of record) and **JP10-89614**, as applied above, and further in view of **US006497098 (Griffin et al).**

US005724805 (Glombe et al) shows and discloses the invention substantially as set forth in the claims with possible exception to:

- precombusting a partial quantity of the oxygen and a partial quantity of the fuel to increase the mixture temperature in the burner, to increase the exhaust gas proportion in the gas mixture before a main combustion space, or both, said precombusting being catalytically initiated, stabilized, or both including a static mixer, or swirler and one or more catalyzer elements.

US006497098 (Griffin et al) teaches, form applicant's same reduced NOx combustion field of endeavor, a combustion system and process including:

- forming a gas mixture (at 30) from oxidant and inert gas (29) and fuel (31);
- wherein the oxidant comprises substantially pure oxygen or a mixture of substantially pure oxygen;
- forming with a mixture of substantially pure oxygen and inert gas, including extracting oxygen with an oxygen transport membrane (9) from an oxygen-containing gas mixture arranged on a retentate side of the membrane, and transporting the extracted oxygen to a permeate side of the membrane, and removing the transported oxygen by scavenging with the inert gas; and
- precombusting a partial quantity of the oxygen and a partial quantity of the fuel to increase the mixture temperature in the burner, to increase the exhaust gas proportion in the gas mixture before a main combustion space, or both, said precombusting being catalytically initiated, stabilized, or both (see figures 4-5) including a static mixer, or swirler (77) and one or more catalyzer elements (79, 80).

In this regard **US006497098 (Griffin et al)** discloses the following:

> (16) It is useful that the catalyzer element 79 located upstream with respect to the flow through the burner 2 or the heat exchanger/burner unit 36 consists of a catalyzer material that is more active than that of the catalyzer element 80 located downstream. It is also useful that the downstream catalyzer element 80 is produced from a thermally more stable material than the upstream catalyzer element 79. While the **upstream catalyzer element 79** therefore is particularly suitable for an **initiation of the combustion**, the **downstream catalyzer element 80** can be used particularly well for **stabilizing the combustion**. If there are more than two catalyzer elements 79, 80, one or more upstream catalyzer elements 79 accordingly may be more active and/or one or more downstream catalyzer elements 80 may be more stable.
>
> (17) The catalyzer 78 is followed by a stabilization zone 81 that brings about an aerodynamic stabilization of the homogeneous reaction zone. Downstream from this stabilization zone 81 is a burn-out zone 82, in which the homogeneous reaction can be completed.

(Highlighting and Underlining Added)

In regard to claims **11** and **15**, for the purpose of forming an aerodynamic stabilization of the homogeneous reaction zone, it would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combustor of **US005724805 (Glombe et al)** to include means for precombusting a partial quantity of the oxygen and a partial quantity of the fuel to increase the mixture temperature in the burner, to increase the exhaust gas proportion in the gas mixture before a main combustion space, or both, said precombusting being catalytically initiated, stabilized, or both including a static mixer, or swirler and one or more catalyzer elements, in view of the teaching of **US006497098 (Griffin et al).**

Claims: Rejected under 35 U.S.C. 103(a)

Claims **17-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US005724805 (Glombe et al)** (of record) in view of **US005154599 (Wunning)** (of record) and **JP10-89614** and **US006497098 (Griffin et al),** as applied above, and further in view of **US005636977 (Benson et al)**.

US005636977 (Benson et al) shows and disclose a combustion process comprising:

- forming a gas mixture from oxidant, fuel, and inert gas (20);
- wherein the oxidant comprises substantially pure oxygen or a mixture of substantially pure oxygen (see column 3, lines 18-25);
- wherein forming the gas mixture comprises mixing the fuel or a mixture of fuel and inert gas at least at two locations (20, 25; 30, 35, 40) in a burner arranged sequentially relative to a through-flow direction of the burner;
- a mixture forming device configured and arranged for the formation of a substantially nitrogen-free gas (the amount of nitrogen being substantially reduced due to the use of pure oxygen) mixture of oxidant, fuel, and inert gas (e.g. – CO_2), and having a burner configured and arranged for carrying out combustion, the mixture forming device configured and arranged to bring oxygen and fuel together in the burner first to form a gas mixture having a temperature above the self-ignition temperature of the gas mixture;
- an internal exhaust gas recirculation system (40); and
- an external exhaust gas recirculation (see as labeled in figure 1).

In regard to claims **17, 18** and **19**, for the purpose of further aiding in the reduction of NOx gas formation, it would have been obvious to a person having ordinary skill in the art to

modify **US005724805 (Glombe et al)**, wherein forming the gas mixture comprises mixing the fuel or a mixture of fuel and inert gas at least at two locations in a burner arranged sequentially relative to a through-flow direction of the burner, in view of the teaching of **US005636977 (Benson et al).**

Conclusion

See the attached USPTO form 892 for prior art made of record and not relied upon which is considered pertinent to applicant's disclosure.

USPTO CUSTOMER CONTACT INFORMATION

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CARL D. PRICE whose telephone number is (571) 272-4880. The examiner can normally be reached on Monday through Friday between 6:30am-3:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Josiah Cocks can be reached on (571) 272-4874. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CARL D. PRICE
Primary Examiner
Art Unit 3749

cp